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SHORT COMMUNICATION: PREVALENCE OF *EIMERIA* spp. INFECTION IN DOMESTIC RABBITS OF POLISH FARMS

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Abstract: Coccidiosis caused by *Eimeria* spp. infection can be a serious problem and a significant cause of economic losses in rabbit farms. The aim of the study was to identify the coccidian species and evaluate the variability in prevalence and OPG (oocysts/gram of faeces) number of *Eimeria* infections in small meat rabbit farms in Poland. To this end, individual faecal samples were collected from animals from 14 different backyard farms and quali-quantitatively analysed by a flotation method (Willis-Schlaaf) and a McMaster technique to assess the presence and the number of *Eimeria* oocysts per gram of faeces, respectively. In addition, *Eimeria* oocysts were identified at species level following sporulation. Ten coccidian species were identified, including nine intestinal *Eimeria* species (*E. exigua*, *E. perforans*, *E. media*, *E. magna*, *E. irresidua*, *E. coecicola*, *E. flavescens*, *E. piriformis*, *E. intestinalis*) and one liver species (*E. stiedai*). The OPG number showed large fluctuations throughout the year. The highest *Eimeria* spp. OPG mean number (21100 OPG) was observed in mid-May. The result obtained revealed that the prevalence of rabbit coccidiosis in Poland backyard farms is high and may contribute to the development of effective control programmes.

Key Words: rabbit, prevalence, coccidiosis, *Eimeria* spp., Poland.

INTRODUCTION

Rabbit is a versatile animal bred for meat, wool, fur and also as a pet animal (Kowalska, 2006; Moonarmart *et al.,* 2018). Rabbit meat is classified as white, fine-grained meat with low fat content, characterised by low cholesterol, which corresponds to the requirements posed by the modern consumer (Kowalska, 2006; Laha *et al.*, 2015). Coccidiosis is considered one of the main limitations for the development of rabbit breeding, as it is often associated with significant economic losses and high mortality in rabbit farms (Peeters *et al.,* 1987; Pakandl, 2009; Szkucik *et al.*, 2014). Coccidiosis is caused by protozoa of the genus *Eimeria* and, according to some authors, this infection is always present in rabbit farms and virtually impossible to eliminate (Vancraeynest *et al.*, 2008). Eleven *Eimeria* species have currently been identified in domestic rabbits (Pakandl, 2009). All of these species are parasites of the intestinal tract, except for *Eimeria stiedai*, which infects the liver (Baker, 2007; Pakandl, 2009; Taylor *et al.*, 2016). Concurrent infections by several *Eimeria* species often occur in rabbits (Catchpole and Norton, 1979).

Among rabbit coccidian species, *Eimeria flavescens* and *Eimeria intestinalis* are considered highly pathogenic, while the remaining nine species are pathogenic or mildly pathogenic (Coudert *et al.*, 1995). However, both clinical and subclinical coccidia infections may cause significant economic losses in rabbit farms due to weight loss, digestive disorders, poor absorption of nutrients, dehydration, diarrhoea, increased susceptibility to bacterial and viral infections,

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death and higher fattening costs often observed in infected rabbits, and to the costs associated with the treatment of infected animals (Pakandl, 2009; Taylor *et al.,* 2016).

Therefore, in rabbit breeding the control of *Eimeria* infection based on the use of effective drugs and hygienic measures is extremely important (Vereecken *et al.,* 2012). For example, the insufficient hygiene of cages used for post-weaned rabbits is considered an important factor for *Eimeria* infection outbreaks (Järvis *et al*., 2013). In the European Community, the use of anticoccidial drugs in rabbits both for prevention and treatment purpose is limited by specific regulations.

The aim of this study was to evaluate the species composition and the variability in prevalence and intensity of oocyst emission of *Eimeria* infections in rabbits bred in backyard farming. These data are in fact very important for the development of preventive measures to reduce the risk of coccidiosis in rabbit herds.

MATERIALS AND METHODS

Animals

The study was carried out on 14 rabbit breeding farms located in West Pomerania (Chojna) and Warmian-Masurian province (Elbląg) of Poland. The farm consistency was from 14 to 85 rabbits and animals were reared for their own needs and on a small scale of sales. Animals were fed with a complete granulated mixture intended for fattening rabbits of meat breeds, containing robenidine hydrochloride as coccidiostat. Deworming treatment was not performed. In these herds, a total of 324 fresh faecal samples from weaned rabbits aged 1.5-4 mo were collected from the ground once a month in the course of a year and examined for coccidia.

Parasitological analysis

Prevalence of *Eimeria* infection and intensity of oocyst emission were assessed using qualitative and quantitative parasitological methods, respectively. More specifically, faecal samples were examined by Willis-Schlaaf flotation test with saturated NaCl solution for qualitative analysis, and quantitatively by a McMaster method with saturated NaCl as flotation solution (Eckert *et al.,* 1995). The number of oocysts per gram of faeces (OPG number) was calculated in all faecal samples. The identification of *Eimeria* species was performed using a morphological identification key based on morphological features of mature (sporulated) oocysts according to descriptions given by several authors (Coudert et al., 1995; Taylor *et al*., 2016) and on sporulation time. For the sporulation of oocysts, faecal samples were dissolved in a 2.5% aqueous solution of potassium dichromate ($K_2Cr_2O_7$) in Petri dishes. Dishes were placed in a moist chamber at 24-26°C (Coudert *et al.,* 1995), and checked daily until sporulation of the oocysts. Oocysts, sporocysts, sporozoites and other structures were microscopically observed by immersion in oil (1000×) and measured by means of an eyepiece micrometer. The percentage of each species in each sample was determined on 50-100 mature oocysts.

RESULTS

Coccidian infection was observed in all examined farms and ten *Eimeria* species were identified, including nine intestinal species and *E. stiedae*, the liver species (Table 1). In all farms, mixed *Eimeria* infections were observed (Table 1) and *E. perforans*, *E. media*, *E. magna* and *E. irresidua* were found to be the prevalent species (Table 1). Prevalence of each species ranged from 15.5% of *E. flavescens* and 98.5% of *E. media* (Table 1). *E. stiedae* was relatively rarely found (19.0%) in examined rabbits (Table 1). At the beginning of the study, the mean OPG number was similar in the different farms and about 21320 OPG. In the course of the year, the average OPG number was 13930.

When analysing the annual dynamic of *Eimeria* OPG, it was evidenced that in the first quarter (January, February, and March) the OPG number was low and ranged from 100 to 12000 OPG. In the second quarter (April, May, June), a slow increase was observed in the OPG number until the middle of May, when it peaked at 15,100 OPG, and persisted at this level until July. In the summer months (July, August, September), the OPG number was only slightly

Table 1: Frequency and number of oocysts per gram of faeces (OPG number) of each *Eimeria* species identified in rabbits on the examined farms.

		OPG number	
Eimeria species	Infection rate (%)	range	$\bar{x}$
E. exigua	94.4	0-300	50
E. magna	84.5	5400-9100	7250
E. irresidua	55.6	5500-14330	94050
E. flavescens	15.5	630-1400	7800
E. intestinalis	40.0	0-250	175
E. media	98.5	19100-6000	7240
E. coecicola	17.3	6300-200	9300
E. perforans	82.5	9700-5000	4950
E. piriformis	8.0	1800-100	490
E. stiedae	19.0	2300-7300	13930

fluctuating (Figure 1). In autumn (October, November, December), a steep drop in the OPG number was observed and it slowly continued to decline in January and February of the following year.

An overall prevalence of 85% was evidenced in the West Pomerania (Chojna) and Warmian-Masurian province (Elbląg) rabbit farms.

DISCUSSION

Coccidiosis is primarily a disease of young rabbits, while infected adults are mostly carriers (Al-Rukibat *et al*., 2001). The disease is seen most frequently in establishments, farms and breeding systems in which hygiene is poor. A strong association between *Eimeria* infection, hygienic status and prevention chemotherapy has been observed (Vereecken et al., 2012; Järviset *al*., 2013; Roman, 2015). Good hygienic conditions help to reduce oocyst contamination, but do not completely remove all oocysts from the environment (Pakandl, 2009).

In previous studies, prevalence of coccidian infection was 41.9-56.4% in different areas and rabbit breeds in China (Jing *et al*., 2012; Yin *et al.,* 2016). In Egypt, where rabbit meat is a valuable source of animal protein, six *Eimeria* species were identified in small rabbit farms, generally in mixed infections (El-Shahawi *et al*., 2012). In Saudi Arabia (Abdel-Baki and Al-Quraishy, 2013), the prevalence of coccidiosis in rabbit farms was 75% and ten *Eimeria* species were identified, with *Eimeria coecicola* (70%), *E. magna* (60%), *E. perforans* (60%) and *E. media* (55 %) as the most common species. *E. stiedai* (5%) and *E. exigua* (5%) were relatively rare. In the subtropical mountainous region of India, 57.28% of rabbits showed *Eimeria* infections and six species were identified (Laha *et al*., 2015).

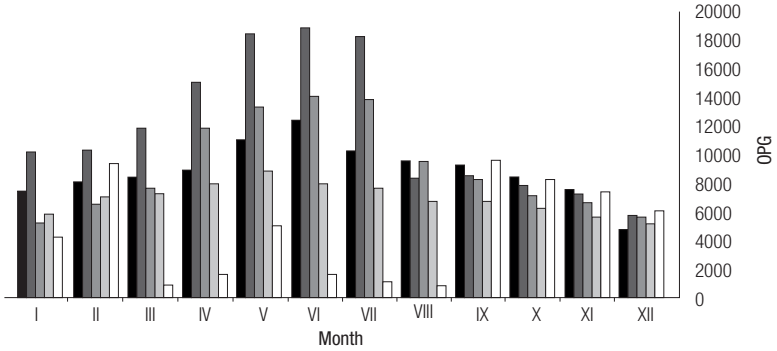

Figure 1: Variability of number of oocysts per gram of faeces (OPG number) of each *Eimeria* species identified in Polish rabbit farms examined in the course of a year. ■ *E. perforans*; ■ *E. media*; ■ *E. irresidua*; ■ *E. magna*; □ *E. stiedai.*

In Europe, the complex research carried out on rabbit coccidiosis in France in the 70s and 80s merits particular attention (Coudert *el al*., 1979). France is a country with extensive experience in the organisation of prevention against coccidiosis in intensive rabbit rearing. For Polish breeders, this country served as a model in the development of control measures of rabbit coccidiosis (Balicka-Ramisz, 1999; Nosal *et al*., 2009; Balicka-Ramisz *et al*., 2014). *Eimeria spp.* have huge economic importance and often lead to huge losses in the production of rabbit meat. Even subclinical forms of intestinal and hepatic coccidiosis may lead to a decrease in body weight gain, intestinal and hepatic dysfunction, diarrhoea and cachexia (Al-Quraishy *et al*., 2012; Metwaly *et al.,* 2013). In the study of Vancraeynest *et al.* (2008), 55 out of 321 rabbits (17.1%) fed pellets containing coccidiostat (robenidine) and a quarter of them were infected with *Eimeria*.

The most common rabbit breeding system in Poland is smallholder production, as controlling coccidiosis is based mainly on the treatment of symptomatic animals. However, studies on rabbit coccidiosis performed in the last decade in Poland mainly concern the prevalence, species composition and dynamic of *Eimeria* infections in large industrial farms and on the development of effective control programmes (Balicka-Ramisz, 1999; Nosal *et al.,* 2009; Balicka-Ramisz *et al.,* 2014; Szkucik *et al*., 2014). In Poland, a noticeable difference in *Eimeria* species composition was evidenced in rabbits from commercial rabbit farms and house farms. Indeed, it was evidenced that in small (house) farms the disease was caused by seven different coccidian species, i.e. *E. stiedai, E. magna, E. perforans, E piriformis, E. media, E. irresidua, E. exigua* (Pastuszko, 1963), while *E. exigua* has been never identified in commercial rabbit farms (Balicka-Laurans, 1993; Nosal *et al*., 2006; Sadzikowski *et al*., 2008: Szkucik *et al*., 2014.). Appropriate treatment with toltrazuril is recommended in symptomatic animals, while coccidiostats (diclazuril, salinomycin and robenidine) are useful for prevention (Beck, 2004). However, in order to avoid the emergence of drug resistance, the use of these drugs in rotation and monitoring their efficacy is recommended (Beck, 2004; Gugołek *et al.,*2007).

The early use of coccidiostats is also recommended, as young rabbits are highly susceptible to the pathogenic effects of coccidia, with severe disease and high mortality rates (Szkucik *et al.,* 2013). The combination of coccidiostats and toltrazuril allows for better prevention of intestinal coccidiosis in rabbit herds by reducing the OPG number and mortality and clinical signs and increasing weight gain and feed conversion (El-Ghoneimy *et al.,* 2017).

Data from the present study evidence a higher average *Eimeria* spp. OPG number in small farms than in commercial rabbit farms, despite the regular use of coccidiostats. This may depend on resistance developed by coccidia to these drugs or, more probably, on lower hygienic conditions in smaller farms. Therefore, the use of regular cleaning and disinfection of cages and a good and complete diet and of dry feed is recommended (Roman, 2015).

CONCLUSION

In conclusion, the present survey revealed that the prevalence of rabbit coccidiosis in Poland backyard farms is high. These results may also represent the basis for implementing and evaluating the effectiveness of control strategies in these rabbit farms.

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